AMENDMENTS TO THE CLAIMS

Claim 1 (currently amended): A method for processing materials, comprising:

passing materials to be processed in a flow path through an annular processing passage between two closely-spaced smooth surfaces provided by respective inner and outer cylindrical apparatus members at least one rotating relative to the another, the height of the annular processing passage is small enough, the cylindrical apparatus members rotate relative to each other rapidly enough and the two closely-spaced smooth surfaces are smooth enough such that the materials are essentially free of Taylor vortices; and

irradiating the materials in the processing passage with processing energy passing through at least one window of one of the two members, wherein the height of the annular processing passage is less than the penetration depth of the processing energy into the materials to be processed.

Claim 2 (original): A method as claimed in claim 1, wherein the energy applied to the processing passage is any one of electromagnetic energy of microwave frequency, light, X-rays, gamma radiation and ultrasonic longitudinal vibrations.

Claim 3 (original): A method as claimed in claim 1, wherein the cylindrical apparatus members rotate relative to one another about respective longitudinal axes that are coaxial with one another so that the radial spacing of the two surfaces is constant circumferentially thereof.

Claim 4 (original): A method as claimed in claim 1, wherein the apparatus members are moved so as to produce a linear velocity between their operative surfaces relative to one another of at least 0.5 meter per second.

Claim 5 (original): A method as claimed in claim 1, wherein one or both of the surfaces is coated with catalytic material that enhances at least one of chemical, bio-chemical and biocidal reactions in the processing passage.

Claim 6 (original): A method as claimed in claim 1, wherein the cylindrical apparatus members rotate relative to one another about respective horizontally oriented parallel longitudinal axes.

Claim 7 (original): A method as claimed in claim 1, wherein the cylindrical apparatus members rotate relative to one another about respective vertically oriented parallel longitudinal axes.

Claim 8 (original): A method as claimed in claim 1, wherein the outer member remains substantially stationary while the inner member rotates to produce a linear velocity between their operative surfaces relative to one another.

Claim 9 (cancelled)

Claim 10 (original): A method as claimed in claim 8, wherein the processing energy irradiating the materials enters the processing passage through at least one window in the wall of the outer member.

Claim 11 (original): A method as claimed in claim 10, wherein the processing energy is electromagnetic energy produced by at least one microwave tube connected to at least one port in the wall of the outer member leading to the at least one window in the wall of the outer member.

Claim 12 (original): A method as claimed in claim 11, wherein the frequency of the electromagnetic energy is between 2.5 GHz and 50 GHz.

Claim 13 (original): A method as claimed in claim 8, wherein the processing energy is light irradiation introduced into the annular processing passage through at least one laser light guide.

Claim 14 (original): A method as claimed in claim 1, wherein the processing energy is produced by at least one transducer.

Claim 15 (cancelled)

Claim 16 (currently amended): A method as claimed in claim 1, wherein the processing energy is electromagnetic energy ~~and the height of the annular processing passage is less than the penetration depth of the electromagnetic energy into the materials to be processed~~.

Claim 17 (previously amended): A method as claimed in claim 16, wherein the frequency of the electromagnetic energy is between 2.5 GHz and 50 GHz and the electromagnetic energy enters the processing passage through at least one window in the wall of the outer member; and further including:

circulating the molecules of the materials to be processed past the at least one window to provide substantially even exposure on a molecular level of the materials to be processed.

Claim 18 (previously amended): A method as claimed in claim 1, wherein the material to be processed is substantially opaque to the processing energy and further comprising the step of circulating the materials to be processed past the processing energy to provide surface renewal so that molecules of the materials to be processed are substantially evenly exposed to processing energy.

Claim 19 (previously amended): A method as claimed in claim 1, wherein:

the materials to be processed include a gas and a liquid;

the height of the annular processing passage is small enough and the cylindrical apparatus members rotate relative to each other rapidly enough so that the gas is emulsified into the liquid to produce a gas/liquid emulsification, thereby increasing the interfacial contact between the gas and liquid; and

the gas/liquid emulsification is irradiated with the processing energy through said at least one window of the two members to facilitate a reaction between the gas and liquid.

Claim 20 (currently amended): A method as claimed in claim 1, ~~wherein:~~

~~the height of the annular processing passage is small enough, the cylindrical apparatus members rotate relative to each other rapidly enough and the two closely spaced smooth surfaces are smooth enough so that the materials to processed are essentially free said Taylor vortices; and~~ further including

irradiating the materials to be processed with the processing energy through at least one window of the two members to facilitate a reaction in the essentially Taylor vortices-free material.

Claim 21 (currently amended): An apparatus for processing material comprising:

two cylindrical apparatus members being mounted concentrically about a common axis for rotation relative to one another, and defining two closely-spaced smooth surfaces providing an annular processing passage constituting a flow path for the material, the height of the annular processing passage is small enough, the cylindrical apparatus members rotate relative to each other rapidly enough and the two closely-spaced smooth surfaces are smooth enough so that the materials to processed are essentially free of Taylor vortices; and

an energy source for applying processing energy to the processing passage through at least one window in at least one wall of the two members, wherein the height of the annular processing passage is less than the penetration depth of said processing energy.

Claim 22 (original): An apparatus as claimed in claim 21, wherein the energy applied to the processing passage is any one of electromagnetic energy of microwave frequency, light, X-rays, gamma radiation and ultrasonic longitudinal vibrations.

Claim 23 (original): An apparatus as claimed in claim 21, wherein the cylindrical apparatus members are mounted to rotate relative to one another about respective longitudinal axes that are

coaxial with one another so that the radial spacing of the two surfaces is constant circumferentially thereof.

Claim 24 (previously amended): An apparatus as claimed in claim 21, wherein the apparatus members are moved so as to produce a linear velocity between their operative surfaces relative to one another of at least 0.5 meter per second.

Claim 25 (original): An apparatus as claimed in claim 21, wherein one or both of the surfaces is coated with catalytic material that enhances at least one of chemical, bio-chemical and biocidal reactions in the processing passage.

Claim 26 (original): An apparatus as claimed in claim 21, wherein the cylindrical apparatus members rotate relative to one another about respective horizontally oriented parallel longitudinal axes.

Claim 27 (original): An apparatus as claimed in claim 21, wherein the cylindrical apparatus members rotate relative to one another about respective vertically oriented parallel longitudinal axes.

Claim 28 (original): An apparatus as claimed in claim 21, wherein the outer member remains substantially stationary while the inner member rotates to produce a linear velocity between their operative surfaces relative to one another.

Claim 29 (original): An apparatus as claimed in claim 28, wherein the processing energy irradiating the materials in the processing passage passes through the wall of the outer member.

Claim 30 (cancelled)

Claim 31 (previously amended): An apparatus as claimed in claim 21, wherein the processing energy is electromagnetic energy produced by at least one microwave tube connected to at least one port in the wall of the outer member leading to the at least one window in the wall of the outer member.

Claim 32 (original): An apparatus as claimed in claim 31, wherein the frequency of the electromagnetic energy is between 2.5 GHz and 50 GHz.

Claim 33 (original): An apparatus as claimed in claim 28, wherein the processing energy is light irradiation introduced into the annular processing passage through at least one laser light guide.

Claim 34 (original): An apparatus as claimed in claim 21, further comprising at least one transducer for producing the processing energy.

Claim 35 (cancelled)

Claim 36 (currently amended): An apparatus as claimed in claim 21, wherein the processing energy is electromagnetic energy ~~and the height of the annular processing passage is less than the penetration depth of the electromagnetic energy into the materials to be processed.~~

Claim 37 (previously amended): An apparatus as claimed in claim 36, wherein the frequency of the electromagnetic energy is between 2.5 GHz and 50 GHz; wherein said at least one window is in the wall of the outer member through which the electromagnetic energy enters the processing passage; and

molecules of the materials to be processed, pass the at least one window, to provide substantially even exposure on a molecular level of the materials to be processed.

Claim 38 (previously amended): An apparatus as claimed in claim 37, wherein the material to be processed is substantially opaque to the processing energy.

Claim 39 (previously amended): An apparatus as claimed in claim 21, wherein:

the materials to be processed include a gas and a liquid;

the height of the annular processing passage is small enough and the cylindrical apparatus members rotate relative to each other rapidly enough so that the gas is emulsified into the liquid to produce a gas/liquid emulsification, thereby increasing the interfacial contact between the gas and liquid; and

the gas/liquid emulsification is irradiated with the processing energy through said at least one window of one of the two members to facilitate a reaction between the gas and liquid.

Claim 40 (currently amended): A method as claimed in claim 21, wherein:

~~the height of the annular processing passage is small enough, the cylindrical apparatus members rotate relative to each other rapidly enough and the two closely-spaced smooth surfaces are smooth enough so that the materials to processed are essentially free of Taylor vortices; and~~

the materials to be processed are irradiated with the processing energy through said at least one window of one of the two members to facilitate a reaction in the essentially Taylor vortices-free material.

Claim 41 (currently amended): A means for electromagnetic processing of material comprising:

two cylindrical apparatus members mounted for rotation relative to one another, and defining two closely-spaced smooth surfaces, the height of the annular processing passage is small enough, the cylindrical apparatus members rotate relative to each other rapidly enough and the two closely-spaced smooth surfaces are smooth enough providing an annular processing passage constituting a flow path for essentially Taylor vortex-free mixing the material; and

a means for supplying electromagnetic energy to the material through at least one window in a wall of the two members.